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PARTIAL MELTING OF AMPHIBOLITE TO TRONDHJEMITE NEAR YKUTAT, ALASKA  
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At Nunatak Fiord, 55km NE of Yakutat, Alaska, a uniform layer of Cretaceous metabasalt ca. 3 km thick was metamorphosed to amphibolite facies and locally partially melted to trondhjemite pegmatite. A region of melting ca. 1 km broad (normal to foliation and layering) fades into unmelted amphibolite (a feature resulting from ingress of aqueous fluid from below?). Segregations of plagioclase-quartz±biotite rock, all presumed to be melt, range in size from stringers several mm thick to blunt pods as much as 6m thick. The ratio of melt/residuum is 5-10%. The assemblage aluminous hornblende-plagioclase (An<sub>34-49</sub> in grain-to-grain variation)-epidote-sphene-quartz gave a water-saturated melt that crystallized to plagioclase(An<sub>23-28</sub>)-quartz-biotite trondhjemite pegmatite. Only one generation of melt is present. The pegmatite segregations tend to be parallel to foliation of the amphibolite, but crosscutting relations are common. Deuteric or late-magmatic quartz seams 1-5mm thick are marginal to many trondhjemite pods.

The amphibolite's protolith was light-REE-depleted oceanic tholeiite of 48.3% SiO<sub>2</sub>, 15.3% Al<sub>2</sub>O<sub>3</sub>, 10.7% FeO\*, 8.4% MgO, 12.6% CaO, 2.27% Na<sub>2</sub>O, 0.08% K<sub>2</sub>O, 0.72% TiO<sub>2</sub>, <0.05% P<sub>2</sub>O<sub>5</sub>, 0.19% MnO, 53ppm Sc, 320ppm Cr, 110ppm Ni, 2ppm Rb, 71ppm Sr, 22ppm Y, 41ppm Zr, <5ppm Nb, 18ppm Ba, and La 3X, Sm 8X, and Lu 12X chondrites. There is no Eu anomaly. Loss/gain of mobile elements by postmagmatic processes cannot be assessed, but probably is minor. The trondhjemite pegmatite shows 75.3% SiO<sub>2</sub>, 15.7% Al<sub>2</sub>O<sub>3</sub>, 0.41% FeO\*, 0.29% MgO, 3.51% CaO, 5.01% Na<sub>2</sub>O, 0.32% K<sub>2</sub>O, 0.04% TiO<sub>2</sub>, <0.05% P<sub>2</sub>O<sub>5</sub>, <0.02% MnO, <5ppm each Sc, Cr, Ni and Nb, 54ppm Rb, 232ppm Sr, 2ppm Y, 506ppm Ba, and La 6X, Sm 0.4X, Gd-Tm 0.3X and Lu 0.7X chondrites. Eu at 2X chondrites shows a strong (+) anomaly. (REE analyses by group separation and activation.) REE partitioning in residuum/melt is even more pronounced than that discussed by Arth and Barker (1976), especially in view of the involvement of sphene and epidote.

Melting of garnet-free amphibolite to give heavy-REE-depleted (relative to residuum) trondhjemitic melt seems to be a viable process.

Arth, J. G., and Barker, Fred, 1976, Geology, 4, 534-536.